

*Sophronitis coccinea*, an epiphytic species with scarlet star-shaped flowers. This was quite common, and could not fail to attract the most unobservant. Of the terrestrial species, several specimens of the very showy *Zygopetalum Mackayii* were found in an open boggy place. Of the woody plants, species of *Gaultheria*, *Gaylussacia*, *Psidium*, *Fuchsia* and *Tibouchina* were noted; herbaceous species included, *Drosera villosa*, *Eriocaulon*, and the very remarkable *Utricularia reniformis* which grew in the water held between the leaf bases of a species of *Vriesia*. The basal portion of the *Utricularia*, lying in the water, shows the characteristic vesicles, but there are developed large orbicular aerial leaves which look almost like small water-lily leaves. The flowers are said to be large and showy. In this same boggy area *Sphagnum amoenum* was seen, and a striking lichen, *Cladonia pycnoclada*. There was the usual profusion of epiphytic bryophytes and ferns, among the latter some small Hymenophyllaceae. *Ophioglossum palmatum* has been collected here, but I was not fortunate enough to find it. A very characteristic epiphytic fern was *Blechnum scandens*. Tree-ferns, species of *Cyathea* and *Alsophila*, were conspicuous in the undergrowth and occasional specimens of *Marattia Kaulfussii* were seen. In places along the paths the banks yielded an abundant harvest of interesting mosses and hepatics, as well as some showy lichens and fungi.

Of the trees, the Leguminosae, so predominant in the dryer forests, were relatively few in number. Much more numerous were various Myrtaceae, Lauraceae, Rubiaceae, Sapotaceae and Rutaceae. A few small specimens of *Podocarpus Sellowii* were the sole representatives of the Gymnosperms. Palms were mostly the smaller species, e. g., *Bactris* and *Geonoma*: but there were some beautiful groups of the exquisite "Jussara" (*Euterpe edulis*).

No botanist visiting Brazil should fail to see the Biological Station at Alto da Serra.

Stanford University, July, 1929.

## THE SANTA CRUZ ISLAND PINE

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The pines of insular California have been little understood due largely to the inaccessibility of some of their habitats. Because of the few collections and their wide dispersal throughout the herbaria of the world, the student of these plants has had in the past little material immediately at hand from which to obtain a correct concept of their range of variation and the limits of their distribution. There is little wonder then that many points of difference between two of these pines should have been overlooked for so long a time.

In the early history of west American botanical collecting, Dr. Palmer collected a pine on Guadalupe Island, 200 miles off the coast of northern Baja California. This was sent to Dr. Engelmann who recognized it as a two needle form of the Monterey Pine. He called it *Pinus insignis* var. *binata*, with the cones of *P. insignis* but the leaves

in pairs (1). As collections from the other islands came in, another pine was found which came to the hands of Lemmon. This came from Santa Cruz Island, 30 miles from the mainland of Alta California. His interpretation of Dr. Engelmann's description led him to suppose that his plant was the same as Dr. Engelmann's *P. insignis* var. *binata*. After adjusting the synonymy that existed in the nomenclature of the Monterey Pine, Lemmon published the name *P. radiata* var. *binata* (Engelm.) Lemmon and included the Santa Cruz Island specimens in the geographic range of the variety (2, 3).

Recently an opportunity was afforded the writer to visit the pine forests of Santa Cruz Island and to study in the field the habits and characters of the pines and to compare this material with specimens from the type locality of Palmer's material. It was found that Dr. Engelmann's description of *P. insignis* var. *binata*, though exceedingly brief, adequately described the specimens from Guadalupe Island but did not take care of the species with the smaller cone from Santa Cruz Island. This, it was found, in its aspect of growth and its manner of bearing cones, more closely resembled *Pinus muricata* Don than *Pinus radiata* Don, and it became evident that a new name was necessary to take care of this species.

Recent studies in the Pleistocene paleobotany of California by Dr. R. W. Chaney and the writer have disclosed that this Santa Cruz Island pine has been distinct at least since early Pleistocene and is now a remnant of a past flora (4). Fossils have been found in the Pleistocene sediments along Willow Creek on Santa Cruz Island where the forest existed contemporaneously with the northern elephant on what is now Santa Cruz Island. In the asphalt deposits at Carpinteria on the mainland of California, other fossils of this species are found in association with *Pinus radiata* Don and *Pinus muricata* Don. Evidence shows this forest to have sheltered the Dire Wolf (5), the last of the native North American horses and the giant condor, all of which are now extinct (5). Because this pine is clearly a relic of past times the name *Pinus remorata* is proposed for the species.

*Pinus remorata* Mason, n. sp. (*P. radiata* var. *binata* Lemmon, in part, West American Cone-bearers 42, 1895.) Slender tree 10 to 20 m. high, maturing to a flat-topped crown; bark furrowed, trunk seldom over 2 to 3 dm. in diameter; foliage dark green, needles in fascicles of two, 2 mm. wide, 8 to 20 cm. long, resin ducts 6 to 12, large; sheath persistent, gray, 10 to 15 mm. long; cone ovate, almost symmetrical, scarcely deflexed on the branches, borne in whorls of 1 to 7 and persistent for many years, 5 to 8 cm. long by 4 to 5 cm. wide, scales of ovulate catkins erect; umbos usually plane, only occasionally somewhat raised and rounded on one side of cone, each scale armed with a minute prickle, the prickle deciduous or sometimes persistent; seed black, somewhat ridged and muriculate, obliquely truncate above and with a rather stout wing.

Santa Cruz Island, California: H. L. Mason no. 4096, type; R. W. Chaney, Oct. 14, 1928. Cedros Island, Baja California: Anthony in 1896, U. C. Herb. no. 118,960.

The species as herein interpreted differs from *Pinus radiata* Don in that the needles are in fascicles of two instead of three. It has this character in common with *P. radiata* var. *binata* (Engelm.) Lemmon. However the needles are very much heavier than in either of these forms. There are also from 6 to 12 resin ducts to a leaf instead of the usual 2 in *P. radiata*. The cones are usually less than 8 cm. long instead of from 8 to 20 cm. They are almost symmetrical instead of strongly asymmetrical and stand almost at right angles to the branch instead of being closely reflexed. The umbos are plane or only slightly rounded instead of being strongly swollen. The tree however in its young stages, like young trees of *P. muricata* Don, resembles those of *P. radiata* very much. However the above points of difference clearly separate *P. remorata* from *P. radiata*. At the present time it is not associated with *P. radiata* but during the Pleistocene they grew together in the same forest.

As pointed out above, the species resembles in its aspect *Pinus muricata* Don more closely than it does *P. radiata* Don. It may be readily distinguished however on the basis of the leaves being a darker green and larger. The scale-tips of the ovulate catkin are erect instead of reflexed. In mature cones the tips of the scales are plane or slightly rounded instead of being produced into a strongly recurved hook. The cones are almost at right angles to the branch and are not reflexed as in *P. muricata*. Ecologically these two species have been associated since early Pleistocene and have been clearly differentiated throughout this time.

Associated with *Pinus remorata* on Santa Cruz Island is *P. muricata* Don, *Quercus tomentella* Engelm., *Lyonothamnus floribundus* Gray, *Photinia arbutifolia* Lindl., *Vaccinium ovatum* Pursh, *Arctostaphylos insularis* Greene, and *Arctostaphylos columbiana* Piper. It is of particular interest to note that *Photinia arbutifolia*, *Vaccinium ovatum*, and *Arctostaphylos columbiana* are characteristically associated with *Pinus muricata* throughout its range. It would seem that this insular pine forest represents the typical pine forest of the coastal and insular region during Pleistocene time of what is now California. The major differences between this forest and the pine forests now remnant in discontinuous localities along the coast seem to be due to the invasion of more highly successful continental species. It is probable that *P. remorata* was not able to compete on the mainland so it disappeared.

I wish to express my appreciation to Dr. R. W. Chaney of the Carnegie Institution of Washington and to Mr. F. F. Caire of Santa Cruz Island for their help in making this study possible.

#### References

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